Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

MINERAL EXPLORATION BOOM IN BRITISH COLUMBIA

- HIGHLIGHTS AND OPPORTUNITIES

by V.A. PRETO

GEOLOGICAL SURVEY BRANCH

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HIGHLIGHTS AND OPPORTUNITIES

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INTRODUCTION

Two years ago I had the pleasure of speaking at this gathering and gave you an optimistic view of mineral exploration in British Columbia, of prospective mine openings and of opportunities for development.

Last year our Chief Geologist, Ron Smyth, gave you a similar overview of B.C.'s latest gold rush and again told you that the future for mineral exploration and mining in our Province looked bright. Today I am here to tell you that those outlooks were all wrong, things are actually better than we thought.

Major diamond drill programs are up 68 percent to 150 for 1987 from 89 in 1986. The number of mineral claims staked to the end of September was 74,500, up 54 percent from 48,300 for the same period in 1986. If this trend continues there will be approximately 106,000 mineral claims staked by year's end, equalling the all time high of 1983. Exploration expenditures are expected to be in the order of Cdn $130 million, up from $94.2 million in 1986 and $80 million in 1985. This again, should be a record.

What is driving all this? The word, as in the past 3 or 4 years is GOLD, GOLD, and more GOLD. Recent estimates by the Mining Association of B.C. are that 1987 gold production is going to be 390,000 oz or nearly 14 tons, up one-third from the 280,000 oz or 10.5 tons produced in 1986. By 1990 production is expected to exceed 600,000 oz or 21 tons, and thus surpass the peak annual production of 20 tons achieved in 1939. But enough for statistics. I would like now to review the most important exploration successes and opportunities in B.C.

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There are at least 25 major underground exploration projects going on in B.C. this year, and at least 50 properties can be listed as having meaningful reserves that are, or are close to being economically viable. At present, a total of 28 projects have formally entered the Government permitting process - 20 of these projects are for gold.

Essentially people are finding gold, silver, and polymetallic deposits with precious metal values in four main environments, with a sprinkling of deposits that are transitional between these models. I would remind you at this time that we have a display in the Trade Centre describing these targets, and you are all invited to visit it.

GOLD ENRICHED SKARNS

The importance of this deposit type was emphasized earlier this year by the opening of the Nickel Plate Mine near Hedley. This old mine, now in its third life, has already produced 1.556 million ounces of gold from 4 million tons of underground ore between 1902 and 1957. The current open pit operation is at a daily rate of 2,400 tons per day. Pittable reserves are 9.9 million tons grading 0.133 oz/ with an additional 2 million tons of similar grade mineable by underground methods. This means the equivalent of 1.365 million ounces of gold which with the past production brings the known gold content of this deposit to roughly 2.92 million ounces. Not bad for a Province that is considered by our eastern colleagues to have only small gold deposits --- and prospects for finding additional reserves are excellent! Gold at Nickel Plate is associated with arsenopyrite and other sulphides in pyroxene skarn associated with lower Jurassic mafic intrusions which cut upper Triassic calcareous sediments and tuffs. Other skarn deposits such as the Canty, French and Good Hope occur nearby at the same stratigraphic position. The recognition of this control by Gerry Ray of the B.C. Geological Survey has drawn at least two majors to the area, and the whole district is under intensive exploration.

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The Nickel Plate Mine will be the second largest gold producer in Western Canada, after Lupin in the Northwest Territories, and one of Canada's lowest cost producers at $125.00 per ounce - capital investment was roughly Cdn $70 million.

British Columbia has in excess of 300 other recorded skarn occurrences - roughly one-third of which are known to contain gold. Some of these have produced in the past, others are potential producers. An overview paper on gold-silver skarns and another on the Tillicum Mountain property are offered on Saturday morning. The Tillicum Mountain Property of Esperanza Explorations has known reserves of 50,000 tons grading 1 oz/t and a drill indicated potential in excess of 200,000 tons. Recent acquisition of the nearby Hailstorm Mountain property by Esperanza has produced encouraging early results. This is a district to watch.

Other potentially economic gold enriched skarns include deposits at Zeballos on Vancouver Island, Banks Island and on Texada Island.

Another deposit which is generally regarded as a porphyry system, but which has skarn affinities is the QR deposit of Placer Dome, west of Likely. Gold occurs in intense propylite alteration in Upper Triassic volcanics and sediments cut by a consanguineous differentiated syenitic stock. Drill indicated pittable reserves are well in excess of 1 million tons grading 0.2 oz/t gold. This deposit is at the feasibility stage. The favourable geology that hosts the Q.R. deposit continues to the northwest along the axis of the Quesnel Trough. Intrusions similar to the Q.R. stock are known to occur in an area of poor exposures. This is an obvious target for more Q.R. type deposits but also a challenge to the explorationist.

EPITHERMAL DEPOSITS

The search for gold bearing epithermal systems has continued at a brisk pace for several years with considerable success. The Blackdome Mine, located 250 km north of Vancouver, began production in May 1986 at 185 tons per day from a classic, high-level epithermal vein system hosted in Eocene sub-aerial volcanic flows and pyroclastics.

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At start up, reserves were 180,000 tons grading 0.79 oz/t gold and 3.76 oz/t silver. The project cost in the order of Cdn $18 million to put in production, and was debt free after 9 months of operation.

New reserves are being found faster than ore is being mined, and were recently increased to 280,000 tons grading 0.74 oz/t and 2.41 oz/t silver. The future for this mine looks very good indeed.

The Toodoggone camp, located 300 km north of Smithers, has been one of the hottest exploration areas in B.C. for several years. More than Cdn $10.6 million was spent in this camp this year, compared to $3.5 million in 1986. This increased activity is due to three factors:

* The completion of road access to the area funded in good part by a Cdn $4.5 million government grant,

* The decision by Cheni Gold Mines to go ahead at a planned 500 tons per day with their Lawyers deposit,

* The considerable success by other projects in the area.

Gold and silver in Toodoggone occur along the central axis of a 100 km x 20 km belt of Early Jurassic subaerial andesitic volcanics and are best known in epithermal systems such as Cheni Gold Mines Lawyers deposit with reserves of 1.9 M t grading 0.196 oz/t gold and 7.09 oz/t Ag, Energex's Al deposit with pittable reserves of 250,000 tons grading 0.25 oz/t Au, Multinational Resource's Chappelle deposit, with reserves estimated at 50,000 tons grading 0.5 oz/t, St. Joe's Silver Pond deposit, and Manson Creek Resource Mets deposit, which has reserves of 160,000 grading 0.33 oz/t gold. Very significant developments in the Toodoggone this year have been the discovery of above average grade gold-silver mineralization at depths of more than 1,100 feet at Lawyer's Cliff Creek zone, the tracing of mineralization by drilling and trenching over a strike length in excess of 2,500 feet at the Al deposit of Energex, and the discovery of gold bearing skarn at Cheni Gold's Acapulco prospect.

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Another deposit that is developing very nicely is the Vancouver Island Mt. Washington property of Better Resources. Mineralization is associated with a Tertiary quartz porphyry and breccia irruptive centre cutting cretaceous Nanaimo Group sediments and occurs in tabular, shallow dipping alteration zones locally up to 30 metres thick. Sulphides are mainly pyrite and arsenopyrite. At the end of 1986, the company had 235,900 tons drill indicated grading 0.23 oz/t gold and 1.15 oz/t silver, and 486,700 tons inferred grading 0.18 oz/t gold. No new reserve figures have yet been released, but to date more than 100 holes have been completed in 1987, as well as a 1,000 foot adit that has yielded a 6,000 ton bulk sample. Gold assays from blast holes and muck samples from the adit have been roughly double the values given by surface diamond drill holes.

On Graham Island on northern Queen Charlotte Islands, City Resources (Canada) Ltd. has completed a thorough re-assessment of the Cinola deposit which represents the exposed mid-upper levels of a Tertiary epithermal hot-spring-type precious metal system.

Details of this deposit will be given by the Company in a paper scheduled for Saturday afternoon. Pittable reserves are roughly 28 million tons grading 0.072 oz/t gold and 2.03 oz/t silver, representing roughly 1.68 million ounces of contained gold.

A number of other interesting epithermal systems were under exploration throughout the Province. Two of particular interest are the Brett property west of Vernon and the Vault property west of Okanagan Falls, both vein systems in Tertiary rocks.

VOLCANICS AND CLASTIC HOSTED MASSIVE SULPHIDE DEPOSITS

Another important target is massive sulphide mineralization with precious metal values. On Vancouver Island, Abermin Corporation has continued an aggressive exploration program on its Lara property near Chemainus, and has just announced its decision to go underground with a decline early in 1988. There was a paper yesterday afternoon describing this deposit.

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Mineralization occurs in Devonian felsic volcanics of the Sicker Group and has many similarities with the world-class H-W deposit of Westmin Resources at Buttle Lake, approximately 60 miles to the north.

To date more than 68,000 feet of drilling in 148 holes have been completed. The zone has been tested to a depth of 500 feet and over a strike length of 1,300 feet. Drill indicated reserves are in excess of 900,000 tons grading 0.12 oz/t gold, 2.8 oz/t silver, 4.5% zinc, 1% lead and 0.75% copper. This includes a high grade lens with a strike length of 500 feet grading 0.23 oz/t gold, 6.7 oz/t silver, 14.0% zinc, 3% lead and 1.4% copper.

The Adams Lake area, 40 miles northeast of Kamloops, has been the focus of intense exploration activity since late 1983 when A. Hilton discovered gold bearing massive sulphides (Rea Gold) near Johnson Lake. The discovery in late 1985 of the Somatosum silver deposit by Minnova Inc. has opened up a new target in this area. This deposit has just entered the permitting process and was described yesterday afternoon in a talk by Alex Davidson. Mineralization is found in tuffaceous sediments of the Palaeozoic Eagle Bay Formation, that lie on top of a thick sequence of mafic volcanics of similar age. Sulphides include tetrahedrite, galena, sphalerite, chalcopyrite and pyrite. Recently released reserves are 660,000 tons open pittable, grading 32 oz/t silver, 0.052 oz/t gold, 3.5% zinc, 1.7% lead and 1.2% copper. Similar mineralization is being pursued on the nearby Twin and Kamad properties of Esso Resources.

In the extreme Northwestern Corner of the Province, Geddes Resources is carrying out a major underground program at the 300 million ton plus Windy Craggy Copper-Gold-Cobalt massive sulphide deposit. This program is designed to test and follow up on a drill intersection of 148 feet grading 0.27 oz/t gold, 0.28 oz/t silver and 1.21% copper.

VEIN TYPE DEPOSITS TRANSITIONAL TO PORPHYRY DEPOSITS

A number of gold deposits that can be classified as transitional between epithermal and porphyry systems occur in Northwestern British Columbia and are in the advanced exploration and development stage.

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Underground development work continued at the Dome Mountain property of Teeshin Resources 25 miles east of Smithers. Gold-silver mineralization occurs in a number of mesothermal sheeted quartz veins in Early to Mid Jurassic volcanics and sediments. Reserves stand at 320,000 tons grading 0.436 oz/t gold and 2.8 oz/t silver. This deposit is at the feasibility stage.

I would now like to focus on the Stewart-Iskut River Gold Belt, one of the busiest, most exciting and promising areas of the Province. At the southeast end of this belt, near Stewart, Westmin Resources is at the production decision stage with their Silbak Premier-Big Missouri project. Quartz stockwork type mineralization occurs in early Jurassic andesitic volcanics intruded by the subvolcanic Premier porphyries. Reserves are reported at 7 million tons grading 0.068 oz/t gold and 2.59 oz/t silver for Silbak Premier, and at significantly more than 1.75 million tons grading 0.105 oz/t gold and 0.86 oz/t silver for Big Missouri. An open pit operation at 2,000 tons per day, with capital costs in excess of Cdn $76 million is anticipated for this project. If Silbak Premier's past production of 1.8 million ounces of gold and 40 million ounces of silver is added to the 0.65 million ounces of gold and 19.6 ounces of silver represented by the current reserves, the total known mineable precious metals contained by these two deposits are 2.45 million ounces of gold and about 60 million ounces of silver.

Twenty-six miles northwest of Silbak Premier, another very active camp is the Sulphurets area, where at least 18 separate mineralized zones have been located in Early Jurassic volcanics intruded by syenites. Mineralization in these zones ranges from copper-moly-gold to disseminated gold to complex gold-silver vein systems and stockworks to simple epithermal veins. One of these zones, the West Zone at Brucejack Lake, continues to be the target of an aggressive underground development program by the Newawk-Lacana Joint Venture. Drill indicated and inferred reserves were 1.6 million tons grading 0.34 oz/t gold and 22.9 oz/t silver at the end of 1986. During 1987, the company spent Cdn $5.1 million in additional drilling and underground exploration to upgrade the indicated tonnage to proven reserves and in building a road and barge link to the property from Highway 37. New reserve figures resulting from this work have not yet been released.

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Perhaps the most exciting developments are occurring thirty miles to the northwest, at the Iskut River end of the Belt, where Skyline Explorations is forging ahead with production plans for their Stonehouse (Reg) deposit. Gold-silver-copper mineralization here occurs in a number of lenses or veins along a 5,000 foot long fracture system in Lower Jurassic volcaniclastic and sedimentary rocks intensely altered to K-feldspar and intruded by syenite. This deposit is transitional between a porphyry system at depth and a mesothermal vein system above. Recent company estimates put measured, inferred and indicated reserves at 938,500 tons grading 0.73 oz/t gold, 0.85 oz/t silver and 0.76% copper with an excellent geological potential for more.

Work in 1987 included start on a lower adit, assembly of a 100 man construction camp, upgrading of the airstrip to accommodate Hercules aircraft, mill construction, wholesale re-sampling of 1986 workings, and further drilling. The Iskut camp was one of the busiest areas in the Province in 1987 with exploration expenditures of roughly Cdn $10 million and at least 15 companies carrying out major programs in addition to Skyline. Most notable amongst these is the Cominco-Delaware Resources joint venture on the nearby Snip property where a major drill program has encountered excellent results from a system of well defined quartz veins over a strike distance of 3,000 feet and a vertical distance of more than 400 feet. Drill intersections within the better parts of the vein system range from 53 feet grading 0.197 oz/t gold to 33 feet grading 2.59 oz/t. Facilities at this property are being upgraded for winter work in anticipation of an underground program.

West of Dease Lake, the North American Metals Corporation - Chevron Minerals Joint Venture continued with underground development work on the Golden Bear Deposit, discovered by Chevron in 1981. A paper on this property will be presented Saturday afternoon. Gold mineralization occurs in silicified and breccia zones along a major fault zone between Permian limestone and upper Triassic andesites. This deposit is vein type with epithermal characteristics. The best mineralization is in flexures or rolls in the fault system. Reserves for the Bear Main Zone are approximately 1.5 million tons grading 0.383 oz/t gold. The deposit is at the feasibility stage. Production at roughly 500 tons per day depends on the availability of road access.

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Southeast of Revelstoke, near the old mining town of Camborne, very promising results have been obtained by the Granges-Windflower Joint Venture from extensive drilling on their Goldfinch property. Native gold and tetrahedrite occur in structurally controlled quartz veins in Palaeozoic metasedimentary and metavolcanic rocks of the Broadview Formation. At least three zones have been identified, including the Dorothy Zone where reserves are indicated at 165,000 tons grading 0.24 oz/t gold, with good potential for more. A Cdn $3 million underground program has just been announced to start immediately.

OTHER DEPOSITS OF INTEREST

A number of other gold deposits of different types are definitely highlights on the British Columbia scene. Some are at the advanced underground development stage like the Abo deposit of the Bema-Kerr Addison Joint Venture at Harrison Lake. Gold here occurs in a quartz vein stockwork in Tertiary quartz diorite. Underground work in 1987 including a 600 foot plus adit, bulk sampling, drilling, and metallurgical testing has met with good success.

Extensive underground development continued at the Willa property of Northair Mines near Slocan. Gold-copper mineralization occurs in silicified porphyries, intrusive breccia and strongly propylitized coeval volcanics of the Lower Jurassic Rossland Group. Reserves stand at 600,000 tons grading 0.22 oz/t gold, 0.3 oz/t silver and 1% copper. A mill is being moved to the property.

On Vancouver Island, Westmin Resources has been carrying out a very aggressive drilling program on their Debbie property, southeast of Port Alberni. This property is in Sicker Group rocks and near the old Thistle mine - a massive sulphide deposit. Gold mineralization has been reported to occur in -

* A magnetite-jasper-sulphide bearing chert with quartz-vein stockwork in footwall basalt,

* An extensive quartz-carbonate-pyrite alteration zone associated with north-south faults that may be related to Tertiary thrust or steep reverse faulting, and

* Separate quartz vein structures.

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BRITISH COLUMBIA GEOLOGICAL SURVEY BRANCH PROGRAMS IN SUPPORT OF MINERAL EXPLORATION

Essential geoscientific data to aid the exploration industry is being provided at an unprecedented rate by the British Columbia Geological Survey Branch thanks to extra funding provided by the 5 year Canada-British Columbia Mineral Development Agreement and by a significant enhancement to the Survey's A-base budget.

Highlights of these programs include:

* Seven new 1:50,000 regional mapping projects in poorly known and under-explored areas.

* Greatly increased mineral deposit mapping by staff geologists.

* Expanded Regional Geochemical Surveys, Orientation Surveys and analysis of geochemical data.

* Aeromagnetic Surveys of specially selected areas.

* Greatly expanded Industrial Minerals Studies for a variety of commodities.

* Expanded Land Use studies to properly evaluate areas proposed for alienation

* MINFILE, a sophisticated, world class mineral inventory file. This system resides of a VAX mini-computer but a simplified P.C. version is also available. Two map sheets have already been released, and several more will be available in the next few months.

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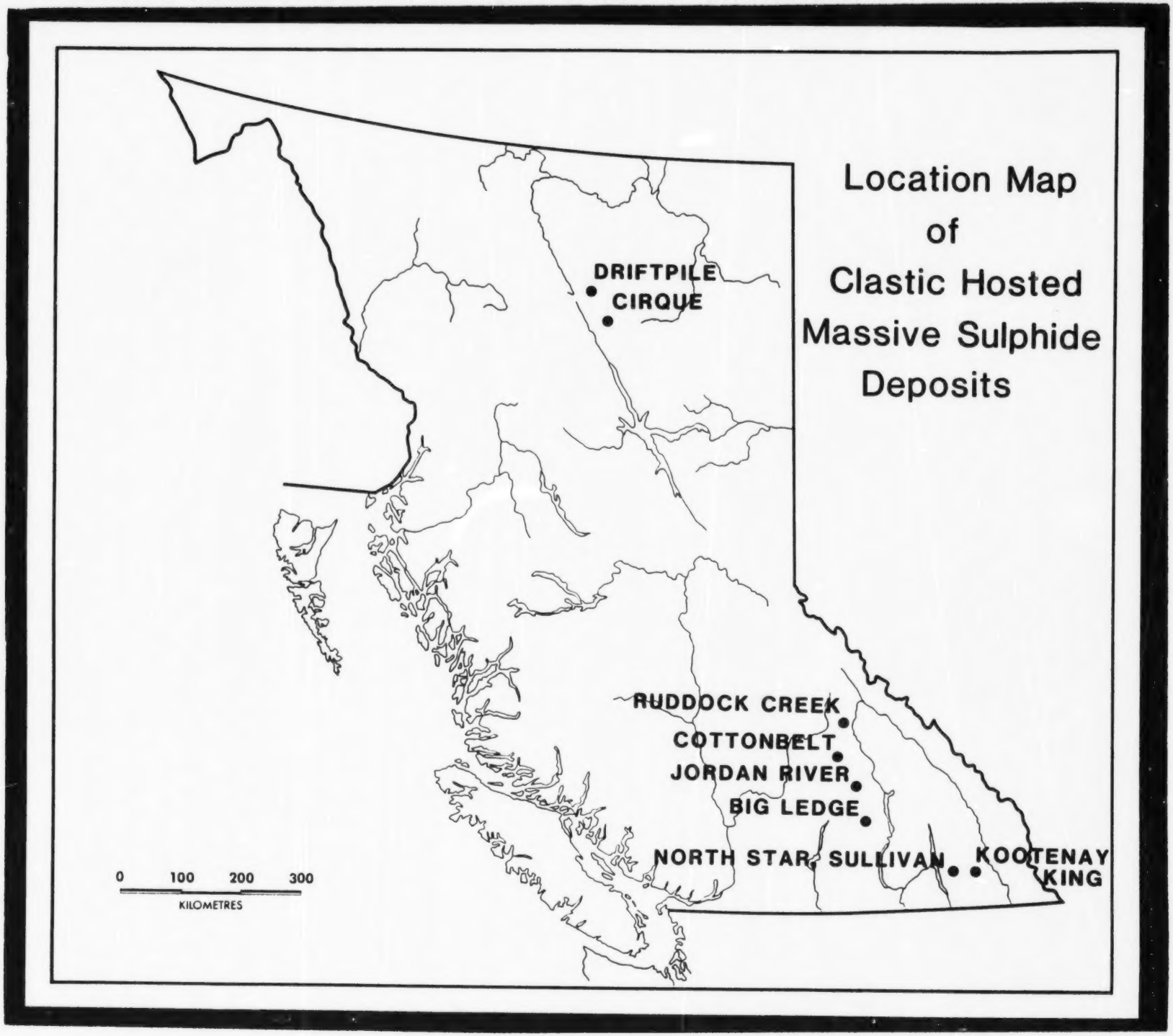
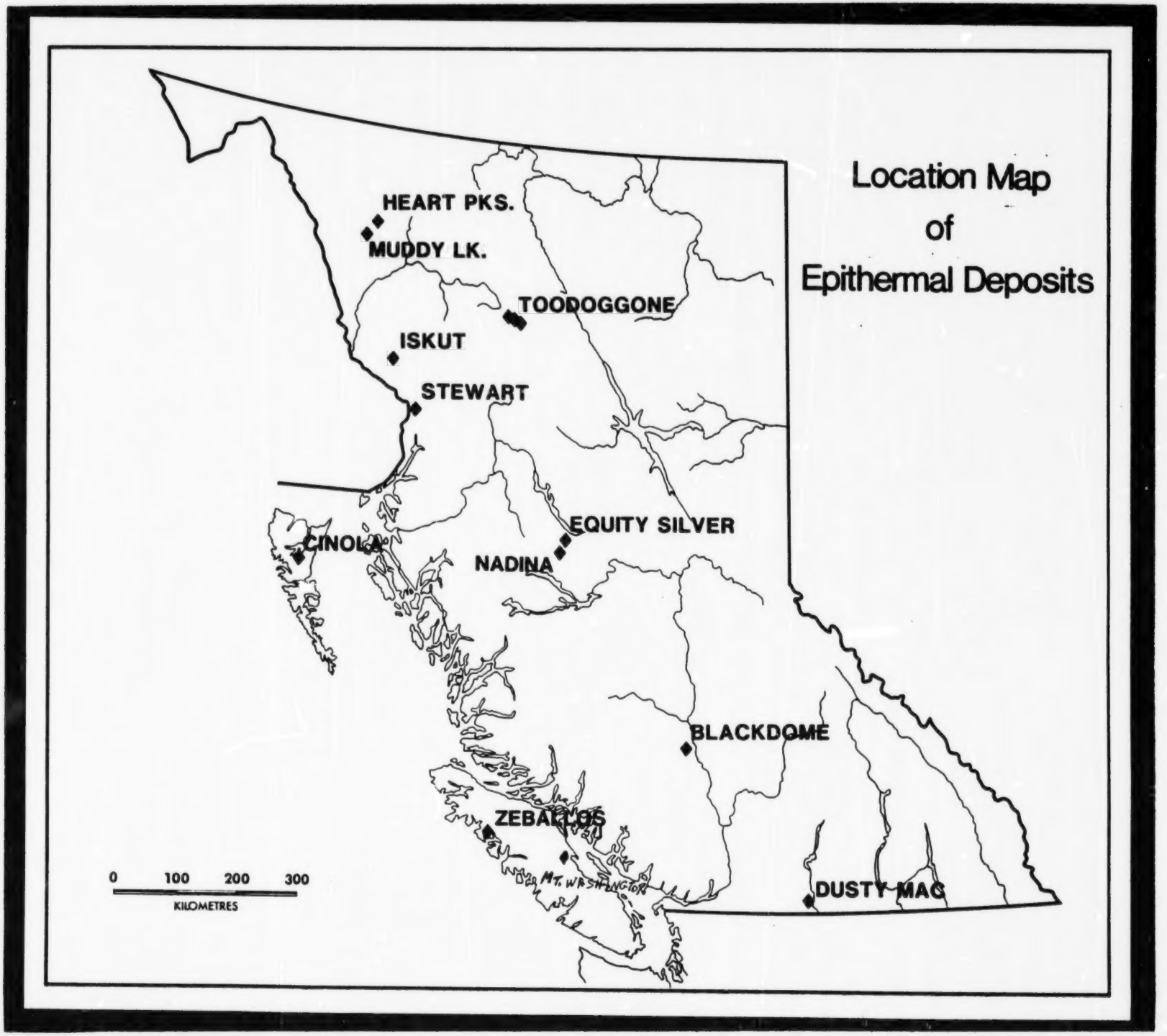
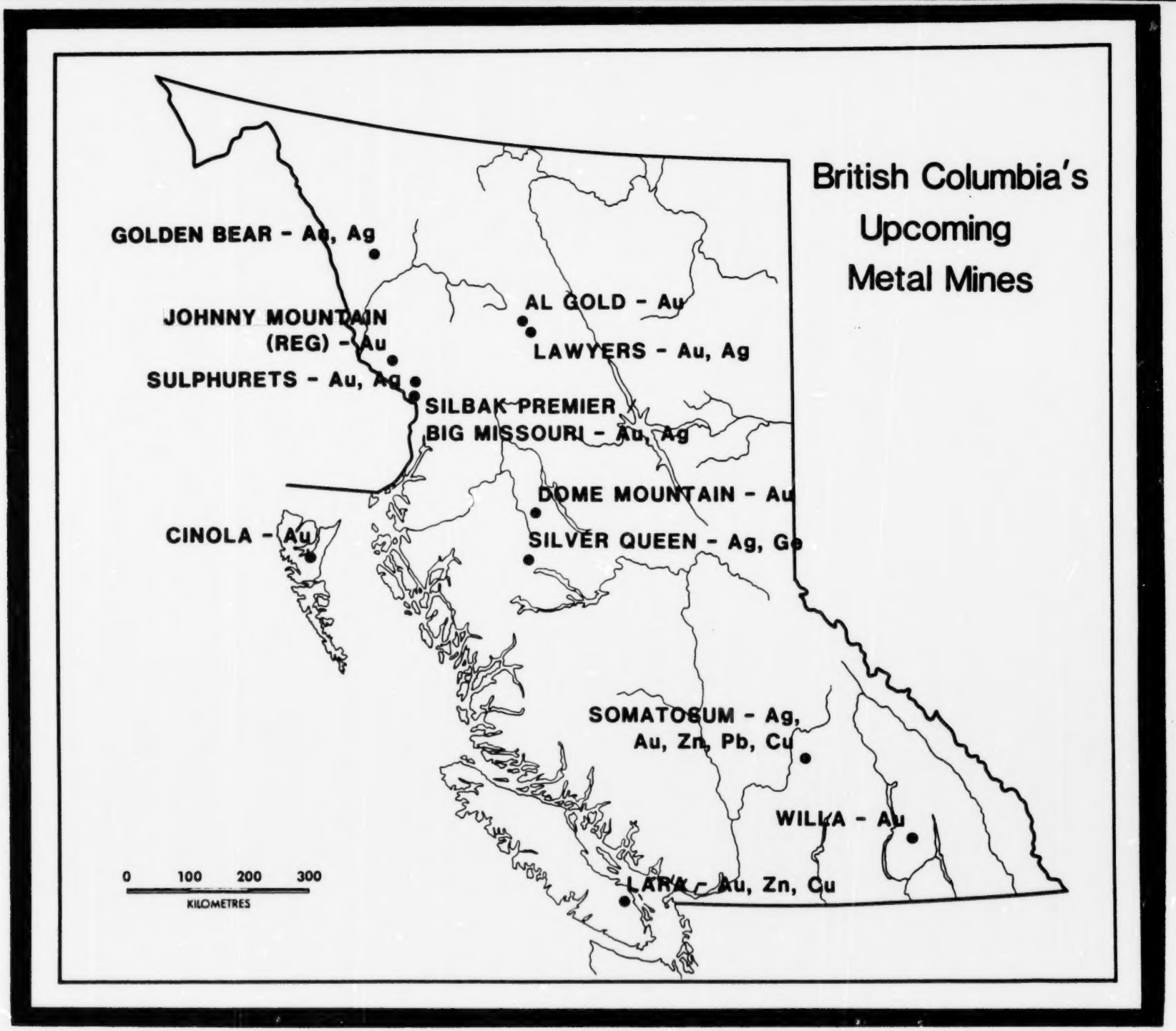
SUMMARY

What I have described are only some of the highlights and main development opportunities of British Columbia's most active exploration year ever. Estimates of how many new mines will open in the next three or four years, and what levels of annual gold production will be obtained will vary with the estimators, results of key programs currently in progress, the decision by Ottawa on what to do with the flow-through shares scheme, and most certainly with the gyrations of the stock market - we all know about that. The fact remains, however, that gold continues to be found in many diverse and new environments, some totally unknown only a few years ago. The greatly increased programs of the British Columbia Geological Survey Branch and the priority that our new Provincial Government promises to place on mining, are providing an added stimulus. The horizons are steadily widening, and the picture is becoming brighter all the time.

Location Map
of
Volcanogenic
Massive Sulphide
Deposits
WINDY CRAGGY
TULSEQUAH CHIEF
KUTCHO CREEK
GRANDUC
ANYOX
ECSTALL
GOLDSTREAM
CHU CHUA
REA, HOMESTAKE,
SOMATOSUM
WESTMIN
BRITANNIA
SENECA
LARA, TWIN J
0 100 200 300
KILOMETRES


Location Map
of
Clastic Hosted
Massive Sulphide
Deposits
DRIFTPILE
CIRQUE
RUDDOCK CREEK
COTTONBELT
JORDAN RIVER
BIG LEDGE
NORTH STAR
SULLIVAN
KOOTENAY
KING
0 100 200 300
KILOMETRES


Location Map
of
Epithermal Deposits
HEART PKS.
MUDDY LK.
TOODOGGONE
ISKUT
STEWART
EQUITY SILVER
CINOLA
NADINA
BLACKDOME
ZEBALLOS
MT. WASHINGTON
DUSTY MAC
0 100 200 300
KILOMETRES


British Columbia's
Upcoming
Metal Mines
GOLDEN BEAR - Au, Ag
JOHNNY MOUNTAIN
(REG) - Au
SULPHURETS - Au, Ag
AL GOLD - Au
LAWYERS - Au, Ag
SILBAK PREMIER
BIG MISSOURI - Au, Ag
DOME MOUNTAIN - Au
SILVER QUEEN - Ag, Ge
CINOLA - Au
SOMATOSUM - Ag,
Au, Zn, Pb, Cu
WILLA - Au
LARA - Au, Zn, Cu
0 100 200 300
KILOMETRES